

CLAIMS

1. A method for process plant design which comprises

(a) preparing a detailed design for a process plant in a product line including a detailed design of at least one engineered component; and

5 (b) preparing a detailed design for another process plant in a different product line wherein the detailed design of the at least one engineered component of (a) is reused in (b).

2. A method for process plant design which comprises:

10 (a) defining a plurality of process plant product lines;

(b) preparing a general process design for each process plant product line;

(c) dividing each of the general process designs of (b) into a plurality of engineered components;

15 (d) determining from the plurality of engineered components of (c) a minimum number of repeatable engineered components and the process attributes thereof which are required for future general process designs;

(e) preparing a detailed design of a process plant in a process plant product line, wherein the detailed design includes

20 (e1) selecting specific repeatable engineered components and the process attributes thereof from the minimum number of repeatable engineered components determined in (d) and

(e2) preparing a detailed design for one or more of the repeatable engineered components selected in (e1); and

25 (f) preparing a detailed design of a process plant in another process plant product line, wherein

(f1) the detailed design includes selecting specific engineered components and the process attributes thereof from the minimum number of repeatable engineered components determined in (d);

5 (f2) at least one of the repeatable engineered components selected in (f1) is identical to one of the repeatable engineered components of (e2) for which a detailed design has been prepared; and

10 (f3) the detailed design of the repeatable engineered component of (e2) is reused in the detailed design of the process plant of (f).

3. The method of Claim 2 which further comprises, as part of (d), modifying the general process designs for one or more of the process plants to optimize the combination of
15 general process designs and the minimum number of repeatable engineered components and the process attributes thereof.

4. The method of Claim 2 which further comprises preparing additional detailed designs of process plants in the process plant product lines wherein each additional detailed
20 process plant design utilizes at least one previous detailed design of a repeatable engineered component.

5. The method of Claim 4 wherein a detailed design is prepared for at least one additional repeatable engineered component.

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6. The method of Claim 5 which further comprises storing design information in electronic format from previous detailed designs of repeatable engineered components in a computer-based document and data management system for future use in additional detailed designs of process plants in the process plant product lines.

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7. The method of Claim 2 wherein the future general process design of each process plant allows acceptable projections of plant capital cost and operating efficiency.

8. The method of Claim 2 wherein the process plant product lines comprise cryogenic air separation plants.

9. The method of Claim 2 wherein the process plant product lines comprise hydrogen production plants.

10. The method of Claim 2 wherein the process plant product lines comprise gas separation pressure swing adsorption plants.

11. The method of Claim 10 wherein the pressure swing adsorption plants are designed for the separation of air.

12. The method of Claim 8 wherein the repeatable engineered components comprise engineered components selected from the group consisting of feed air cleanup systems, main heat exchangers, reboilers, distillation column sections, cold enclosures, main air compression systems, air booster compressors, gas expanders, recycle compressors, process control systems, warm piping, cold piping, cryogenic liquid pumps, and product gas compressors.

13. The method of Claim 12 wherein each distillation column section is defined by the column diameter and the height of vapor-liquid mass transfer devices.

5 14. The method of Claim 12 wherein each main air compression system is defined by maximum air flow rate and discharge pressure.

15. The method of Claim 12 wherein each gas expander is defined gas flow rate and pressure ratio.

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16. The method of Claim 8 wherein the process plant product line includes plants which produce one or more products selected from the group consisting of oxygen gas containing 95-99 vol% oxygen, oxygen gas containing up to 99.8 vol% oxygen, liquid oxygen, nitrogen gas containing between about 0.1 to 1 parts per million by volume non-nitrogen components, nitrogen gas containing up to about 0.5 parts per billion by volume non-nitrogen components, and liquid nitrogen.

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17. A method for process plant design which comprises:

(a) defining a plurality of process plant product lines;

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(b) defining a minimum number of repeatable engineered components and the process attributes thereof such that specific repeatable engineered components can be selected therefrom and combined in a general process design of each process plant product line;

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(c) preparing a detailed design of a process plant in a process plant product line which includes selecting specific repeatable engineered components from the minimum number of repeatable engineered components defined in (b),

wherein the detailed design of the process plant includes preparing a detailed design of at least one of the selected repeatable engineered components; and

(d) preparing detailed designs of one or more additional process plants in different process plant product lines which includes selecting specific repeatable engineered components from the minimum number of repeatable engineered components defined in (b), wherein at least one of the specific repeatable engineered components selected in (d) is identical to the selected repeatable engineered subsystem of (c) for which the detailed design was prepared, and preparing additional detailed designs of repeatable engineered subsystems required for the detailed designs of additional process plants in (d), wherein at least one of the process plant product lines in (d) is different than the process plant product line in (c); and

(e) storing design information from the detailed designs of repeatable engineered components in (c) and (d) in a design database for future use in additional detailed designs of process plants in the process plant product lines.

18. The method of Claim 17 wherein the future general process design of each process plant allows acceptable projections of plant capital cost and operating efficiency.

19. The method of Claim 17 which further comprises preparing a general process design of a process plant suitable for a cost proposal, wherein the general process design comprises:

- (1) determining the process plant requirements of a potential buyer;
- (2) choosing from the process plant product line a selected process plant which satisfies the requirements of the potential buyer; and

(3) preparing a general process design of the selected process plant which includes utilizing repeatable engineered components selected from the minimum number of repeatable engineered components defined in (b).

5 20. The method of Claim 19 which further comprises utilizing the general process design of the selected process plant to prepare a cost proposal for the potential buyer.

21. The method of Claim 20 which further comprises preparing a detailed design of the selected process plant which includes utilizing the design information of (e) for the

10 repeatable engineered components selected in (3).

22. A method for process plant design which comprises:

(a) defining a plurality of process plant product lines, generating a first set of electronic documents containing the definitions of the process plant product lines, and storing the first set of electronic documents in a computer-based document and data management system;

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(b) preparing a general process design for each process plant product line, generating a second set of electronic documents containing process design information for each process plant, and storing the second set of electronic documents in the computer-based document and data management system;

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(c) dividing each of the general process designs of (b) into a plurality of engineered components;

(d) determining from the plurality of engineered components of (c) a minimum number of repeatable engineered components and the process

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attributes thereof which are required for future general process designs, generating a third set of electronic documents which contain information defining

the minimum number of repeatable engineered components and the process attributes thereof, and storing the third set of electronic documents in the computer-based document and data management system;

(e) preparing a detailed design of a process plant in a process plant product line, wherein the detailed design includes

(e1) selecting specific repeatable engineered components and the process attributes thereof from the minimum number of repeatable engineered components determined in (d) and retrieving information in electronic form on the specific repeatable engineered components and the process attributes thereof from the third set of electronic documents in the computer-based document and data management system;

(e2) preparing a detailed design for one or more of the repeatable engineered components selected in (e1), generating a fourth set of electronic documents containing detailed design information; and storing the fourth set of electronic documents in the computer-based document and data management system;

(f) preparing a detailed design of a process plant in another process plant product line, wherein

(f1) the detailed design includes selecting specific engineered components and the process attributes thereof from the minimum number of repeatable engineered components determined in (d) and this selected information is retrieved in electronic form from the third set of electronic documents in the computer-based document and data management system;

(f2) at least one of the repeatable engineered components selected in (f1) is identical to one of the repeatable engineered components of (e2) for which a detailed design has been prepared and stored electronically in the computer-based document and data management system; and

(f3) the detailed design of the one repeatable engineered component of (e2) is retrieved in electronic form from the fourth set of electronic documents and is reused in the detailed design of the process plant of (f).

23. A method for cryogenic air separation plant design which comprises:

(a) defining a plurality of cryogenic air separation process plant product lines;

(b) preparing a general process design for each cryogenic air separation process plant product line;

(c) dividing each of the general process designs of (b) into a plurality of engineered components;

(d) determining from the plurality of engineered components of (c) a minimum number of repeatable engineered components and the process attributes thereof which are required for future general cryogenic air separation process plant designs;

(e) preparing a detailed design of a process plant in a cryogenic air separation process plant product line, wherein the detailed design includes

(e1) selecting specific repeatable engineered components and the process attributes thereof from the minimum number of repeatable engineered components determined in (d) and

(e2) preparing a detailed design for one or more of the repeatable engineered components selected in (e1); and

(f) preparing a detailed design of a process plant in another cryogenic air separation process plant product line, wherein

(f1) the detailed design includes selecting specific engineered components and the process attributes thereof from the minimum number of repeatable engineered components determined in (d);

(f2) at least one of the repeatable engineered components selected in (f1) is identical to one of the repeatable engineered components of (e2) for which a detailed design has been prepared; and

(f3) the detailed design of the repeatable engineered component of (e2) is reused in the detailed design of the process plant of (f).

24. The method of Claim 23 wherein the repeatable engineered components comprise engineered components selected from the group consisting of feed air cleanup systems, main heat exchangers, reboilers, distillation column sections, cold enclosures, main air compression systems, air booster compressors, gas expanders, recycle compressors, process control systems, warm piping, cold piping, cryogenic liquid pumps, and product gas compressors.

25. The method of Claim 24 wherein each distillation column section is defined by the column diameter and the height of vapor-liquid mass transfer devices.

26. The method of Claim 24 wherein each main air compression system is defined by maximum air flow rate and discharge pressure.

27. The method of Claim 24 wherein each gas expander is defined gas flow rate and
5 pressure ratio.

28. The method of Claim 23 wherein the process plant product line includes plants which produce one or more products selected from the group consisting of oxygen gas containing 95-99 vol% oxygen, oxygen gas containing up to 99.8 vol% oxygen, liquid
10 oxygen, nitrogen gas containing between about 0.1 to 1 parts per million by volume non-nitrogen components, nitrogen gas containing up to about 0.5 parts per billion by volume non-nitrogen components, and liquid nitrogen.

29. A system for process plant design which comprises:

15 (a) a database storing a detailed design of a first process plant in a first product line including a detailed design of at least one engineered component; and

(b) at least one workstation in communication with the database, wherein the at least one workstation is configured to retrieve the detailed design of the at
20 least one engineered component for a user preparing a detailed design of second process plant in a second product line different from the first product line using the retrieved detailed design of the at least one engineered component using the workstation.

30. The system of claim 29 wherein the database is stored at the workstation.

31. The system of claim 29 which further comprises a home server and a database server in communication with the home server, wherein the database resides on the database server.

5 32. The system of claim 31 which further comprises a satellite server in communication with the home server and the database server, wherein another workstation is connected to the satellite server.

33. A method for cryogenic air separation plant design which comprises:

10 (a) preparing a detailed design for a cryogenic air separation plant in a first product line, wherein the detailed design includes a detailed design of an engineered component, and wherein the engineered component includes at least one of a feed air cleanup system, a main heat exchanger, a reboiler, a distillation column section, a cold enclosure, a main air compression system, an air booster
15 compressor, a gas expander, a recycle compressor, a process control system, a warm piping system, a cold piping system, a cryogenic liquid pump, and a product gas compressor; and

20 (b) preparing a detailed design for another cryogenic air separation plant in a second product line different from the first product line using the detailed design of the engineered component.

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